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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/605,087	09/08/2003	Rama Divakaruni	FIS920030007	2086

32074 7590 08/11/2004

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EXAMINER	
THOMAS, TONIAE M	

ART UNIT	PAPER NUMBER
2822	

DATE MAILED: 08/11/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/605,087	DIVAKARUNI ET AL.	
	Examiner	Art Unit	
	Toniae M. Thomas	2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 September 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-17* is/are pending in the application.

4a) Of the above claim(s) *14-17* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *08 September 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. This action is a first Office action on the merits of Application Serial No. 10/605,087. Currently, claims 1-17 are pending.

Election/Restrictions

2. Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. Claims 1-13, drawn to a process of making an array of DRAM cells, classified in class 438, subclass 243.

II. Claims 14-17, drawn to an integrated circuit including an array of DRAM cells, classified in class 257, subclass 302.

3. The inventions are distinct, each from the other because of the following reasons: Inventions I and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case, the product as claimed can be made by another and materially different process. For example, in another and materially different process, the first and second set of trenches are formed in the same step.

4. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

5. During a telephone conversation with Steven Capella on 15 July 2004 a provisional election was made without traverse to prosecute the invention of Group I, claims 1-13. Affirmation of this election must be made by applicant in replying to this Office action. Claims 14-17 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

6. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Specification

7. The specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

8. *Claims 2-12 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.*

It is unclear as to which trenches the phrase *said trenches* recited in claim 2, line 3 refers to: the first set of trenches, the second set of trenches, or both the first and second set of trenches. For purposes of examination, the phrase is interpreted to mean one of the first and second trenches or both.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

9. *Claims 1-8 and 13 are rejected under 35 U.S.C. 102(b) as being anticipated by Radens et al. (US 6,437,388 B1).*

The Radens et al. Patent (Radens) discloses a method of forming an array of DRAM cells (figs. 3-13 and accompanying text). The method comprises the following steps: forming trench capacitors in a first set of trenches 12 in a semiconductor substrate 14, wherein each capacitor comprises a buried plate 16, a capacitor dielectric 17, a collar 18, and a storage node 20 (fig. 3 and col. 4, line 63 – col. 5, line 7); forming vertical transistors above the trench capacitors in the first set of trenches, wherein each of the vertical transistors

comprises a gate oxide layer 30 and a gate conductor 28 (fig. 3 and col. 5, lines 14-22), and wherein the capacitors and vertical transistors are connected by a set of buried straps 24 formed at a strap depth in a layer of the substrate (fig. 2); forming a second set of trenches in the substrate, the second set of trenches being disposed between members of the first set of trenches (fig. 5 and col. 6, lines 3-9), the second set of trenches having an insulating liner 44 at the strap depth (figs. 6, 7, and col. 6, lines 14-21), whereby potential paths between adjacent buried straps in the first set of trenches are blocked from forming; and the second set of trenches contain a vertical conductive path 42 connecting body regions in the substrate 14 at a level above the strap 24 depth and bias regions in the substrate at a level below the strap 24 depth (fig. 5 and col. 6, lines 3-9).

The second trenches are etched within upper and lower regions of a well 40, such that the upper and lower regions of the well are connected by a conductive path 42 (fig. 5). The well 40 is formed prior to the formation of the second set of trenches (fig. 4 and col. 5, lines 42-47).

The liner 44 is formed on the interior surfaces of second set of trenches, and etched on the bottom surface of the second set of trenches, so that the conductive path extends to the substrate through the bottom surface (fig. 6 and col. 6, lines 22-25).

Each of the second set of trenches is filled with a conductive material 48 (fig. 6 and col. 6, lines 24-28). Subsequently, the conductive material is diffused into the substrate at region 50 (fig. 6 and col. 6, lines 29-33).

The each of the second set of trenches is formed with a transverse dimension that is the minimum distance permitted by lithography (figs. 4, 5, col. 5, lines 57-61, and col. 6, lines 3-7).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. *Claims 9-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Radens et al. in view of Hodges et al. (US 5,260,229).*

It is noted that in the specification, a step of nitriding the interior surface of the second set of trenches occurs separately from the step of forming the nitride insulating liner within the second set of trenches, both steps of which are performed prior to the step of filling the second set of trenches with a conductive material (par. 47-51). However, for purposes of examination, the nitriding step recited in claims 9-12 is interpreted as the step for forming the insulating liner of claim 1, since the claim language does not preclude this interpretation.

As discussed above, Radens discloses forming a second set of trenches in the substrate, the second set of trenches being disposed between members of the first set of trenches *and* having an insulating liner 44 at the strap depth. The insulating liner is formed prior to filling the trenches with a conductive material (col. 6, lines 14-19). In a preferred embodiment, the insulating liner is a silicon nitride layer (col. 6, lines 14-19). While Radens teaches that the insulating liner is a silicon nitride layer, Radens does not teach that the silicon nitride insulating liner is formed by nitriding the interior surface of the second set of trenches. Instead, the insulating liner is formed by depositing a silicon nitride film.

The Hodges et al. patent (Hodges) discloses a method of forming isolation regions (figs. 1, 2A, 3A and accompanying text or figs. 1, 2B, 3B and accompanying text). This method comprises forming a silicon nitride layer 14 on a substrate 10 by one of a deposition technique, chemical vapor deposition (CVD), and rapid thermal nitridation (RTN) (fig. 1 and col. 3, lines 19-27). Hodges suggests that nitridation can be used in place of CVD as an alternate method for forming silicon nitride films.

Since both Radens and Hodges are from the same field of endeavor, the purpose for which Hodges is relied upon would have been recognized in the pertinent reference of Radens by one of ordinary skill in the art at the time the invention was made.

It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to form the silicon nitride liner layer 44 by nitriding the interior surface of the second set of trenches, instead of by depositing a silicon nitride film, since nitridation is an alternate method used to form silicon nitride films.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Toniae M. Thomas whose telephone number is (571) 272-1846. The examiner can normally be reached on Monday-Thursday from 8:30 a.m. to 5:30 p.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (571) 272-1852. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

TMT
02 August 2004

Mary Wilczewski
Primary Examiner